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(54) **AUTOMATIC ANALYZER DEVICE**

AUTOMATISCHER ANALYSATOR

DISPOSITIF D'ANALYSE AUTOMATIQUE

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**EP-A2- 1 892 531 WO-A1-2012/120755
WO-A1-2012/120755 JP-A- 2008 051 532
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Description**TECHNICAL FIELD**

[0001] The present invention relates to an automatic analyzer performing a qualitative/quantitative analysis of a biological sample, such as blood or urine, and in particular to a processing during suspension of an automatic analyzer provided with a function of automatically executing maintenance functions of the automatic analyzer.

BACKGROUND ART

[0002] An automatic analyzer performs, as daily maintenance, an analysis preparation processing performed when the analyzer is turned on or before an analysis is started, a rinse processing before the analyzer is turned off after an analysis terminates, and the like.

[0003] Further, there are many maintenance items associated with the analysis preparation processing and the rinse processing, and it takes time to perform such processing.

[0004] Therefore, regarding an automatic analyzer presetting an analysis preparation function performed when power is turned on or before an analysis is started, thereby performing a preparation function processing completely without waste, Japanese Patent Application Laid-Open No. H02-80962 (Patent Document 1) or Japanese Patent Application Laid-Open No. H08-338848 (Patent Document 2) proposes such an analyzer.

[0005] Further, Japanese Patent Application Laid-Open No. H08-338846 (Patent Document 3) proposes an automatic analyzer automatically executing an analysis termination processing before a power source of the analyzer is turned off.

[0006] Further, regarding a rinsing function before an analysis is started and when an analysis is terminated, Japanese Patent Application Laid-Open No. H08-338847 (Patent Document 4) proposes such a function.

[0007] Further, Japanese Patent Application Laid-Open No. 2012-018103 (Patent Document 5) proposes a system correctly calculating a maintenance duration time, thereby performing efficient maintenance.

[0008] The document WO 2012/120755 A1 discloses an analysis device performing selected maintenance tasks according to a recommended order. The document EP 1 892 531 A2 discloses an analysis device performing a sequence of maintenance tasks which is configured to issue an error signal when an error occurs before the operation is completed.

RELATED ART DOCUMENTS**PATENT DOCUMENTS**

[0009]

Patent Document 1: Japanese Patent Application Laid-Open No. H02-80962

Patent Document 2: Japanese Patent Application Laid-Open No. H08-338848

Patent Document 3: Japanese Patent Application Laid-Open No. H08-338846

Patent Document 4: Japanese Patent Application Laid-Open No. H08-338847

Patent Document 5: Japanese Patent Application Laid-Open No. 2012-018103

SUMMARY OF THE INVENTION**PROBLEMS TO BE SOLVED BY THE INVENTION**

[0010] By the way, while a plurality of maintenances are being executed in pipe functions sequentially automatically executing an analysis preparation processing or an analysis terminating processing described in the above patent document 1, a failure in a mechanical system may occur, or a consumable supply required for executing maintenance may become insufficient, and accordingly suspension/stop may occur without completing all maintenance items set as the pipe functions.

[0011] The automatic analyzers described in patent documents 2 to 5 may similarly be suspended/stopped during performance of a preparation function processing or maintenance, or the like.

[0012] Further, since a plurality of maintenance items may cooperate with each other to achieve an intended function so as to complete all maintenance items set as the pipe functions, it is also conceivable that simply re-executing a maintenance item(s) following a suspended maintenance item(s) may be insufficient.

[0013] Therefore, as a recovery processing in a case where the pipe functions are suspended/stopped, re-executing the pipe functions from the first, or causing an operator to confirm each maintenance item following a completed maintenance item(s) and designate and execute the maintenance items one by one is required.

[0014] However, if the pipe functions are re-executed from the start, a maintenance item(s) successfully completed is/are consequently repeated, and accordingly there has been a problem that a consumable supply for executing maintenance is unnecessarily consumed again, or maintenance time is wasted.

[0015] On the other hand, in a case where maintenance items are designated and executed one by one by an operator, operator's work takes a longer time, and accordingly decrease in efficiency is a problem.

[0016] Therefore, an object of the present invention is to provide an automatic analyzer achieving both restraining unnecessary usage of a consumable supply and reduction of burdens on an operator, and being capable of completely efficiently performing an analysis preparation processing or an analysis termination processing in a re-executing processing in a case where pipe functions are suspended/stopped.

[0017] The above described and other objects and novel features of the invention will be illustrated by the description of the specification and the accompanying drawings. The invention is defined by the claims.

MEANS FOR SOLVING THE PROBLEMS

[0018] That is, the summary is to include an analyzing unit for analyzing a liquid sample; an input unit for inputting an analysis condition of the liquid sample; a display unit for displaying the inputted analysis condition; a storage unit for storing data analyzed in the analyzing unit and the analysis condition; and a control unit for controlling the analyzing unit, the input unit, the display unit, and the storage unit. The storage unit stores information on pipe functions for sequentially executing a plurality of maintenance items associated with a preparation processing performed before an analysis by the analyzing unit and a post-analysis processing performed after an analysis by the analyzing unit, and information on re-execution setting for setting a re-execution maintenance item from which re-execution is started with respect to the suspended maintenance item if the pipe functions of the plurality of maintenance items are suspended halfway, the information on pipe functions and the information on re-execution setting both being inputted from the input unit; and the control unit sequentially executes the plurality of maintenance items based on the information on the pipe functions, and re-executes maintenance from the re-execution maintenance item associated with the suspended maintenance item, based on the suspended maintenance item and the information on re-execution setting, if the pipe functions of the plurality of maintenance items are suspended.

EFFECTS OF THE INVENTION

[0019] Among the inventions disclosed in the application, an advantageous effect obtained by the representative will be briefly explained as below.

[0020] That is, the advantageous effect obtained by the representative is that, even if the pipe functions are suspended halfway, only minimum essential maintenance items can be re-executed, so that efficient maintenance achieving both restraint of consumption of a consumable supply and shortening of maintenance time, and reduction of burdens on an operator can be executed.

BRIEF DESCRIPTIONS OF THE DRAWINGS

[0021]

FIG. 1 is a configuration diagram showing a configuration of an automatic analyzer according to an embodiment of the present invention;
FIG. 2 is a diagram showing an example of a reagent bottle used in an automatic analyzer according to an embodiment of the present invention;

FIG. 3 is a diagram showing an example of a sample container used in an automatic analyzer according to an embodiment of the present invention;

FIG. 4 is a diagram showing an example of a setting screen of pipe functions of an automatic analyzer according to an embodiment of the present invention;

FIG. 5 is a diagram showing a set-value input example of a setting screen of pipe functions of an automatic analyzer according to an embodiment of the present invention;

FIG. 6 is a function concept diagram in accordance with a time course of pipe functions and pipe function setting of an automatic analyzer according to an embodiment of the present invention;

FIG. 7 is a diagram showing an example of an instruction screen for re-execution of pipe functions of an automatic analyzer according to an embodiment of the present invention;

FIG. 8 is a diagram showing a setting example at the time of re-execution of pipe functions of an automatic analyzer according to an embodiment of the present invention;

FIG. 9 is a flowchart showing a re-execution processing in a case where pipe functions of an automatic analyzer are suspended for some reason according to an embodiment of the present invention;

FIG. 10 is a diagram showing another setting example at the time of re-execution of pipe functions of an automatic analyzer according to an embodiment of the present invention; and

FIG. 11 is a diagram showing another setting example at the time of re-execution of pipe functions of an automatic analyzer according to an embodiment of the present invention.

Detailed Description

[0022] Hereinafter, an embodiment of the present invention based on an outline of the embodiment will be described in detail with reference to the accompanying drawings. Note that components having the same function are denoted by the same reference symbols throughout the drawings for describing the embodiments, and the repetitive description thereof will be omitted.

<Configuration and Basic Functions of Automatic Analyzer>

[0023] With reference to FIG. 1 to FIG. 3, a configuration and basic functions of an automatic analyzer according to an embodiment of the present invention will be described. FIG. 1 is a configuration diagram showing a configuration of an automatic analyzer according to an embodiment of the present invention, FIG. 2 is a diagram showing an example of a reagent bottle used in an automatic analyzer according to an embodiment of the present invention, and FIG. 3 is a diagram showing an

example of a sample container used in an automatic analyzer according to an embodiment of the present invention.

[0024] In FIG. 1, many sample containers 1 containing a sample, such as a liquid sample, are arranged on a sample disk 2. A supply drain nozzle of a sampling unit 5 is connected to a syringe pump for a sample 7.

[0025] Functions of the syringe pump for a sample 7 and the sampling unit 5 are controlled by a computer 3 that is a control unit performing function control of each unit and operations on measured data via an interface 4.

[0026] Many reaction containers 6 are arranged on a reaction table 17 rotatably provided to an incubation bath 9 to form a reaction line. Constant temperature liquid maintained at 37 degrees Celsius is supplied from a constant-temperature-liquid supplying unit 10 to the incubation bath 9.

[0027] A light source 14 and a multiwavelength spectroscopy 15 are provided, and the reaction table 17 is rotationally transferred so as to cause a row of the reaction containers 6 to pass across a light beam from the light source 14. The reaction container 6 after use is rinsed by a rinsing unit 19 and provided for reuse.

[0028] A stirring unit 13 mixes a sample added in the reaction container 6 and reagent liquid associated with an analysis item of the sample with each other. A measurement signal based on reaction liquid obtained by the multiwavelength spectroscopy 15 is converted from an analog signal to a digital signal by an A/D converter 16, and inputted into the computer 3.

[0029] On a reagent disk 26A for a first reagent and a reagent disk 26B for a second reagent, a variety of reagent bottles 12 associated with respective analysis items are circumferentially placed. That is, the reagent disks 26A and 26B are selectively-rotatable reagent bottle housing units.

[0030] A barcode reader 23A is provided in the vicinity of the reagent disk 26A, and the barcode reader 23B in the vicinity of the reagent disk 26B. A reagent pipetting instrument includes reagent pipettors 8A and 8B and a syringe pump for a reagent 11.

[0031] These reagent pipettors 8A and 8B suck and hold predetermined amounts of reagent liquids in the reagent bottles 12 stopped at sucking positions into supply drain nozzles, and these supply drain nozzles are turned to above the reaction container row, and reagent pipettors 8A and 8B discharge the reagent liquids held into the reaction containers 6 stopped at reagent receiving positions. The reagent liquids pipetted at this time are of kinds associated with analysis items assigned to respective reaction containers.

[0032] An analyzing unit includes the sample disk 2, the reaction container 6, the light source 14, the multiwavelength spectroscopy 15, the reagent disk 26A for a first reagent, the reagent disk 26B for a second reagent, and other pipetting or rinsing configuration units.

[0033] Reagent barcode labels 22 having barcodes printed on the outer walls of the respective reagent bottles

12, as shown in FIG. 2, are attached to the reagent bottles 12.

[0034] Information which is displayed as this barcode is, for example, a reagent bottle code unique to each bottle composed of a sequence number, a size of the bottle, an expire date of the sample liquid, a reagent pipetting order indicating that the reagent is a first reagent, a second reagent or a third reagent, a maximum allowable number of analyses of the reagent liquid, a reagent pipetting amount showing a pipetting dose, a manufacturing lot number, and the like.

[0035] Further, the reagent information read by the barcode readers 23A and 23B from each reagent bottle 12 is stored in the storage unit 25 or each corresponding memory area of the computer 3.

[0036] Once the reagent bottles 12 are housed in the reagent disks 26A, and 26B, the reagent information is read by the barcode readers 23A and 23B, and at that time a signal indicating a set position of each reagent bottle is outputted by a rotation angle detecting unit provided in each sample disk, and inputted into the computer 3 via the interface 4. The reagent information and the bottle set position and the analysis item are stored so as to be associated with each other.

[0037] An operator can input various information using a screen of a CRT 18 that is a display unit and a keyboard 21 that is an input unit. A measurement result of an analysis item can be displayed on the printer 27 and the CRT 18. Information on a recording medium 24 is read by its reader, and stored in the storage unit 25 or an appropriate memory area of the computer 3.

[0038] Information stored in the storage 24, for example, includes the following: an analysis item code displayed in five digits; a parameter commonly used in the analysis item; a parameter stored individually for each reagent bottle; and the like.

[0039] Of them, the parameter commonly used in the analysis item includes a wavelength used in a photometer, a sample volume, a calibration method, a standard concentration, a number of standard liquids, an analysis-failure check limit value, and the like. Further, the parameter for each reagent bottle includes a reagent kind, a reagent pipetting order, a reagent bottle code, a reagent liquid volume, a reagent pipetting amount, a maximum allowable number of analyses, a reagent manufacturing date, and the like.

[0040] The storage 25 unit stores, in addition to the information read from the recording medium 24, an operation condition of each unit of the automatic analyzer, an analysis parameter of each analysis item, a determination logic performing management of each reagent bottle, a maximum allowable number of analyses read from a reagent bottle, an analysis result, and the like.

[0041] The reagent information is provided by the recording medium 24 provided by a manufacturer at the time of delivery of the reagent bottles. In a case where the reagent information is not prepared by the recording medium 24, the operator can also input information on a

visual checking paper attached to the reagent bottle into the automatic analyzer via the screen and the keyboard 21.

[0042] A sample barcode label 50 having a barcode printed is attached to an outer wall of the sample container 1, as shown in FIG. 3. Information displayed as this barcode is, for example, a sample identification number uniquely identifying a sample.

[0043] This number is read by a barcode reader 28, and a correspondence between a sample position and the sample identification number is recognized according to angle detection of the sample disk 2.

[0044] On the other hand, an analysis item associated with the sample identification number is inputted and stored in advance via the keyboard 21 and the CRT 18, and consequently the sample position and the sample identification number and the analysis item are stored so as to be associated with each other at the previous barcode reading time. Further, whether the sample is a standard sample, a control sample or a general sample can be generally identified by an upper number of the sample identification number.

[0045] In an analysis of the entire automatic analyzer, as described below, sampling, reagent pipetting, stirring, photometry, rinsing of the reaction container, and data processing such as concentration conversion are conducted in this order.

[0046] A plurality of sample containers 1 containing a sample are placed on the sample disk 2. The sample disk 2 is controlled by the computer 3 via the interface 4. Further, the sample disk 2 causes the sample barcode label 50 on the outer wall of the sample container 1 to be read by the barcode reader 28, and the sample and the analysis item are associated with each other.

[0047] Thereafter, the sample containers 1 are rotationally moved to below a probe of the sampling unit 5 in the order of samples to be analyzed, and the sample in a predetermined sample container 1 is pipetted by a predetermined amount into the reaction container 6 by a function of the syringe pump for a sample 7 coupled to the sampling unit 5.

[0048] The reaction container 6 having the sample pipetted is moved to a first reagent adding position in the incubation bath 9. A reagent sucked from the reagent bottle 12 is added by a predetermined amount into the reaction container 6 that is moved by a function of the syringe pump for a reagent 11 coupled to the supply drain nozzle of the reagent pipettors 8A, 8B. The reaction container 6 after the first reagent addition is moved to a position of the stirring unit 13, where first stirring is performed.

[0049] In a case where a first reagent to a fourth reagent are set on the reagent disks 26A and 26B, addition to stirring of such a reagent is performed on each of the first to fourth reagents.

[0050] The reaction container 6 having the content stirred is caused to pass across a light flux emitted by the light source, and an absorbance at this time is de-

tected by the multiwavelength spectroscope 15. A signal of the absorbance detected is inputted into the computer 3 via the interface 4 through the A/D converter 16, and converted into a sample concentration.

[0051] Data converted into concentration is outputted in a printing manner from the printer 27 via the interface 4, and displayed on the screen of the CRT 18. The reaction container 6 after photometry is moved to a position of the rinsing unit 19, rinsed with rinsing liquid after the content is discharged by a container washing pump, and provided for a next analysis.

<Maintenance Processing According to Pipe Function Setting >

[0052] Next, with reference to FIG. 4 to FIG. 6, a maintenance processing by pipe function setting of an automatic analyzer according to an embodiment of the present invention will be described.

[0053] FIG. 4 is a diagram showing an example of a setting screen of pipe functions of an automatic analyzer according to an embodiment of the present invention, FIG. 5 is a diagram showing a set-value input example of a setting screen of the pipe functions of an automatic analyzer according to an embodiment of the present invention, and FIG. 6 is a function concept diagram in accordance with a time course of the pipe functions and the pipe function setting of an automatic analyzer according to an embodiment of the present invention.

[0054] First, before maintenance is executed in the automatic analyzer, the operator sets a maintenance item from which re-execution starts if the pipe functions are suspended, for each maintenance item, on such a setting screen of pipe functions displayed on the screen of the CRT 18 by the computer 3 as shown in FIG. 4.

[0055] The setting screen of pipe functions, as shown in FIG. 4, displays a maintenance item list 102 selected as a pipe function item from a maintenance item list 101, and is provided with a re-execution setting input box 103 for setting a maintenance item from which re-execution starts at the time of re-execution of the pipe functions for each maintenance item that is selected.

[0056] According to information set on this setting screen of pipe functions, daily maintenance, such as a preparation processing performed when the automatic analyzer is turned on or before an analysis is started, or a post-analysis processing and a rinsing processing before the automatic analyzer is turned off after completion of an analysis, is performed.

[0057] In the case of the pipe function setting shown in FIG. 4, five maintenance items from No.1 Air Purge to No.5 Photometer Check included in the maintenance item list 102 are sequentially executed.

[0058] Air purge is maintenance for removing air bubbles inside a syringe tube of a pipettor used to suck/discharge liquid, such as a specimen sample or a reagent or a washing agent, and the air bubbles in a flow channel connected to the syringe tube. A pipettor is composed of

the syringe tube, a plunger, and the like, and the syringe tube is filled with water. The plunger is driven by a motor so as to increase or decrease a volume of water in the syringe tube, thereby controlling a volume of water in the flow channel including a tube connected to the syringe tube. A probe is connected to a distal end of the tube, and, with the probe immersed in such liquid as a specimen sample or a reagent or a washing agent, the liquid is sucked by driving the plunger to suck. Further, after the probe is moved to a predetermined position, the liquid is discharged by driving the plunger to discharge. At this time, if an air bubble remains in the flow channel connected to the inside of the syringe tube, as compared with a case where the flow channel is filled with water, the volume of water in the flow channel cannot be well controlled by the sucking and discharging function of the plunger. Therefore, air purge for removing air bubbles in the flow channel is required for accuracy of liquid pipetting.

[0059] A maintenance item number may be inputted into the re-execution setting input box 103, as shown in FIG. 4, or a maintenance item number may be inputted therein with a select button 103a, as shown in FIG. 5.

[0060] A maintenance number to be inputted into the re-execution setting input box 103 shown in FIG. 4 is a maintenance number performed at the time of re-execution of the pipe functions if maintenance of the pipe function items is suspended.

[0061] In the case of the re-execution setting shown in FIG. 4, as shown in FIG. 6, during execution of the pipe functions, if a maintenance function stops 401b during execution of No. 2 Reagent Prime and then re-execution is instructed, the re-execution starts 402b from No. 1 Air Purge.

[0062] Similarly, if a maintenance function stops 401e during No. 5 Photometer Check, and then re-execution is instructed, the re-execution starts 402e from No. 4 Cell Blank Measurement.

<Re-Execution Processing in a case where Pipe Functions are suspended for some reason>

[0063] Next, with reference to FIG. 7 to FIG. 9, a re-execution processing in a case where the pipe functions of an automatic analyzer are suspended for some reason according to an embodiment of the present invention will be described. FIG. 7 is a diagram showing an example of an instruction screen for re-execution of pipe functions of an automatic analyzer according to an embodiment of the present invention, FIG. 8 is a diagram showing a setting example at the time of re-execution of pipe functions of an automatic analyzer according to an embodiment of the present invention, and FIG. 9 is a flowchart showing a re-execution processing in a case where pipe functions of an automatic analyzer are suspended for some reason according to an embodiment of the present invention.

[0064] If pipe functions are suspended for some reason, the automatic analyzer stores the suspended main-

tenance item(s).

[0065] Then, the automatic analyzer displays the maintenance item and execution date and time, and the like, on such a maintenance screen displayed on the screen of the CRT 18 as shown in FIG. 7, and in a case where re-execution exactly as set in the re-execution setting of the pipe function setting shown in FIG. 4 is performed, the operator instructs re-execution of the pipe functions with a re-execution button of pipe functions 201 shown in FIG. 7.

[0066] Alternatively, in a case where not re-execution exactly as set in the re-execution setting of the pipe function setting shown in FIG. 4 but re-execution started from an arbitrary maintenance item is performed at the time of re-execution of the suspended pipe functions, such a re-execution screen of the pipe functions as shown in FIG. 8 is displayed on the CRT 18.

[0067] The re-execution screen of the pipe functions displays in a list 301, maintenance items included in the suspended pipe functions, and has means 302 showing an operator a suspended maintenance item, and means 303 showing an operator a preset re-execution maintenance item.

[0068] The means 302 showing an operator a suspended maintenance item or the means 303 showing an operator a preset re-execution maintenance item may be displayed in special color, or a special mark 302a, 302b associated with each maintenance item may be additionally displayed.

[0069] The operator selects a maintenance item to be performed at the time of re-execution from the suspended maintenance item or the preset re-execution maintenance item, and makes the determination with the select button 304.

[0070] The selected re-execution maintenance item is displayed as a re-execution maintenance item 305 so as to be easily recognized by the operator. The display 305 of the selected re-execution maintenance item may be displayed in another display area, or may be displayed in a highlighting manner 305a on the maintenance item list 301.

[0071] A re-execution maintenance item is selected, and the pipe functions are re-executed from the selected maintenance item with an execution button 306.

[0072] Once the pipe functions are re-executed with the re-execution button of the pipe functions 201 shown in FIG. 7, or the execution button 306 shown in FIG. 8, as shown in FIG. 9, first, the stored suspended maintenance item is retrieved from the pipe function setting (step S101), and whether or not a re-execution maintenance item is designated is determined (step S102).

[0073] At step S102, for example, if a re-execution maintenance item is designated on such a re-execution screen of the pipe functions as shown in FIG. 8, it is determined that re-execution is performed from the designated maintenance item (step S103), or if a re-execution maintenance item is not designated at step S102, it is determined that re-execution is performed from the in-

interrupted maintenance item (step S104).

[0074] Then, after completion of determination of a re-execution maintenance item at step S103 or step S104, whether or not re-execution is possible is determined based on judgment about a remaining amount of a consumable supply or a status of a mechanical system used for a maintenance item, following the re-execution maintenance item (step S105).

[0075] Then, if re-execution is possible at step S105, the pipe functions are re-executed (step S106), or if re-execution is not possible at step S105, the operator is informed that execution is impossible by means such as triggering a system alarm (step S107), and the processing is terminated.

<Another Setting Example of Pipe Function Setting>

[0076] Next, with reference to FIG. 10 and FIG. 11, other setting examples at the time of re-execution of pipe functions of an automatic analyzer according to an embodiment of the present invention will be described.

[0077] FIG. 10 and FIG. 11 are diagrams showing other setting examples at the time of re-execution of pipe functions of an automatic analyzer according to an embodiment of the present invention. FIG. 10 is a setting example for performing interrupt execution of a maintenance item other than a maintenance item registered in pipe functions when the suspended pipe functions are re-executed, and FIG. 11 is a setting example for changing maintenance items to be interrupted depending on a cause of suspension and executing the maintenance items, when the pipe functions suspended are re-executed.

[0078] As shown in FIG. 10, as another setting example of a pipe function setting, for each maintenance item of the maintenance item list 102 registered as pipe functions, the re-execution setting input box 103 and an interrupt item input box 110 for a maintenance to be interrupted are provided.

[0079] By setting reset or the like in this interrupt item input box 110, a set maintenance item to be interrupted is performed at the time of re-execution of the pipe functions.

[0080] The setting example shown in FIG. 10 indicates that a reset function is executed before execution of air purge or before execution of cell blank measurement. The interrupt item input box 110 for maintenance to be interrupted may be a multiple-choice system for selecting a maintenance item name, a number associated with a maintenance item, or the like.

[0081] Reset of a maintenance item is a function of returning a position of each unit to an original position. Even when a mechanical system causes a function failure and stops during execution of maintenance, the units can be moved to proper positions by executing reset.

[0082] Further, in the setting in FIG. 10, air purge is performed as a first function of the pipe functions, and incubation water exchange is performed as a third func-

tion of the pipe functions. If no failure occurs during a series of pipe functions, incubation water exchange is performed soon after performance of air purge. In incubation water exchange, a hitargent solution is sucked from a reagent bottle and discharged into the incubation bath during maintenance, and therefore performing air purge in advance is beneficial. However, after completion of air purge of the pipe functions, if a failure occurs during incubation water exchange, consequently air purge and incubation water exchange are not sequentially performed and suspended. If time elapses in that state, the effect of air purge performed first is lost, pipetting and discharging of the hitargent solution may not be correctly performed. In order to solve this problem, air purge is set as an interrupt item with respect to the incubation water exchange in pipe function setting in FIG. 10. In the case of restart from incubation water exchange, air purge is executed before incubation water exchange, so that pipetting and discharging of the hitargent solution can be correctly performed.

[0083] Further, as shown in FIG. 11, another setting example of the pipe function setting, an area capable of setting an interrupt item depending on a cause of suspension associated with a plurality of causes of suspension is provided.

[0084] The setting example shown in FIG. 11 has two kinds of areas: a setting area 112 for a maintenance item to be executed when a cause of suspension is a function failure of a mechanical system; and a setting area 113 for a maintenance item to be executed in the event of a shortage of a consumable supply.

[0085] If the pipe functions are suspended because of a mechanical system failure, a reset function is executed before execution of air purge or before execution of cell blank measurement, and setting for a case where the pipe functions are suspended because of a shortage of a consumable supply indicates that reagent prime is executed as a maintenance item to be interrupted.

[0086] In the setting example shown in FIG. 11, setting is such that reagent prime is interrupted before reagent prime, so that reagent prime is executed twice. Reagent prime is a maintenance item for filling a reagent flow channel with the reagent, and the filling function is performed a plurality of times as a recovery processing responding to the occurrence of a shortage of the reagent during the filling. Thus, an effect of increasing reliability can be expected.

[0087] It should be noted that, in FIG. 11, two causes of suspension are described as an interrupt item depending on a cause of suspension, but causes of interruption may be classified into three or more, or a number capable of identifying a cause of suspension, such as an alarm number, may be used for the classification. Further, setting of suspension classification may be changeable, so that an operator may perform registration.

[0088] As described above, according to this embodiment, in the pipe function setting, since a re-execution maintenance item in a case where pipe functions are

suspended/stopped is reset, and a re-execution processing is performed from the re-execution maintenance item that is set with respect to the suspended/stopped maintenance item, both restraining unnecessary usage of a consumable supply and reduction of burdens on an operator are achieved, so that an analysis preparation processing or an analysis terminating processing can be completely efficiently performed.

[0089] Further, by setting skip in the interrupt item box, if a maintenance item is stopped abnormally during pipe functions, it is also made possible to continuously execute a following maintenance item without suspension. Even when reagent prime is stopped because of a shortage of a consumable supply in the setting shown in FIG. 11, if setting is such that a following pipe function item is not affected by success and failure of a reagent prime function, it may be more efficient to continue pipe functions without suspension.

REFERENCE SIGNS

[0090] 1... sample container, 2... sample disk, 3... computer, 4... interface, 5... sampling unit, 6... reaction container, 7... syringe pump for a sample, 8A, 8B... reagent pipettor, 9... incubation bath, 10... constant temperature liquid supplying unit, 11... syringe pump for a reagent, 12... reagent bottle, 13... stirring unit, 14... light source, 15... multiwavelength spectroscope, 16... A/D converter, 17... reaction table, 18... CRT, 19... rinsing unit, 21... keyboard, 22... reagent barcode label, 23A, 23B... barcode reader, 24... recording medium, 25... storage unit, 26A, 26B... reagent disk, 27... printer, 28... barcode reader, 50... sample barcode label, 101... maintenance item list, 102... maintenance item list selected as pipe function items, 103... re-execution setting, 103a... multiple-choice type re-execution setting, 110... setting of a maintenance item to be interrupted, 112... setting of a maintenance item to be interrupted depending on a cause of suspension (cause of mechanical system failure), 113... setting of a maintenance item to be interrupted depending on a cause of suspension (cause of consumable supply shortage), 201... re-execution button of pipe functions, 301... maintenance item list included in suspended pipe functions, 302... example of displaying a suspended maintenance item in color, 302a... example of displaying a suspended maintenance item with a mark, 303... example of displaying a preset re-execution maintenance item in color, 303a... example of displaying a preset re-execution maintenance item with a mark, 304... re-execution maintenance select button, 305... example of displaying a selected re-execution maintenance item in another area, 305a... example of displaying a re-execution maintenance item selected in a highlighting manner, 306... re-execution button of pipe functions, 401b... stop during execution of reagent prime, 401e... stop during execution of photometer check, 402b... re-execution function after stop during execution of reagent prime, 402e... re-execution function after stop during execution of photometer

check.

Claims

1. An automatic analyzer comprising:

an analyzing unit configured for analyzing a liquid sample;
 an input unit (12) configured for inputting an analysis condition of the liquid sample;
 a display unit (18) configured for displaying the inputted analysis condition;
 a storage unit (25) configured for storing data analyzed in the analyzing unit and the analysis condition; and
 a control unit (3) configured for controlling the analyzing unit, the input unit (12), the display unit (18), and the storage unit (25),
 wherein the storage unit (25) is configured to store information on pipe functions, wherein the pipe functions are a plurality of maintenance items which may cooperate with each other to achieve an intended function, wherein the information on pipe functions is for sequentially executing a plurality of maintenance items associated with a preparation processing performed before an analysis by the analyzing unit and a post-analysis processing performed after an analysis by the analyzing unit, wherein the information on pipe functions is inputted from the input unit (12), and
 wherein the control unit (3) is configured to sequentially execute the plurality of maintenance items based on the information on the pipe functions upon performing said preparation processing or said post-analysis processing,

characterized in that

the storage unit (25) is further configured to store information on re-execution setting for setting a re-execution maintenance item from which re-execution is started with respect to the suspended maintenance item if the pipe functions of the plurality of maintenance items are suspended halfway,
 wherein the information on re-execution setting is inputted from the input unit (12),
 wherein the control unit (3) is configured to re-execute maintenance from the re-execution maintenance item associated with the suspended maintenance item, based on the suspended maintenance item and the information on re-execution setting, if the pipe functions of the plurality of maintenance items are suspended.

2. The automatic analyzer according to claim 1,

wherein the control unit is configured to display the suspended maintenance item and the information on re-execution setting on the display unit when the suspended pipe functions are re-executed, and is configured to perform re-execution from a selected maintenance item, based on selection information on whether re-execution is performed from the re-execution maintenance item inputted from the input unit, or re-execution is performed from an arbitrary different maintenance item.

3. The automatic analyzer according to claim 1, wherein the storage unit (25) is configured to store information on a maintenance item set as an interrupt item that is set for each of the plurality of maintenance items, and the control unit (3) is configured to execute the interrupt item, if the information on an interrupt item is set in a maintenance item, before re-executing the suspended pipe functions.
4. The automatic analyzer according to claim 3, wherein the interrupt item is set so as to be associated with a plurality of causes of suspension for which the pipe functions are suspended, and the control unit (3) is configured to select the interrupt item, based on the cause of suspension for which suspension has occurred, when the suspended pipe functions are re-executed.

Patentansprüche

1. Automatisches Analysegerät, umfassend:

eine Analyseeinheit, die dazu ausgelegt ist, eine flüssige Probe zu analysieren;
 eine Eingabeeinheit (12), die dazu ausgelegt ist, einen Analysezustand der flüssigen einzugeben;
 eine Anzeigeeinheit (18), die dazu ausgelegt ist, einen eingegebenen Analysezustand anzuzeigen;
 eine Speichereinheit (25), die dazu ausgelegt ist, in der Analyseeinheit analysierte Daten und den Analysezustand zu speichern; und
 eine Steuereinheit (3), die dazu ausgelegt ist, die Analyseeinheit, die Eingabeeinheit (12), die Anzeigeeinheit (18) und die Speichereinheit (25) zu steuern,

wobei die Speichereinheit (25) dazu ausgelegt ist, Informationen über Schrittfolgen-Funktionen zum sequentiellen Ausführen einer Vielzahl von Wartungsschritten zu speichern, die mit einer Vorbereitungsverarbeitung, die vor einer Analyse durch die Analyseeinheit durchgeführt wird, und einer Nachanalyseverarbeitung, die nach einer Analyse durch

die Analyseeinheit durchgeführt wird, zusammenhängen, wobei die Informationen über Schrittfolgen-Funktionen über die der Eingabeeinheit (12) eingegeben werden, und

die Steuereinheit (3) dazu ausgelegt ist, die Vielzahl von Wartungsschritten auf der Grundlage der Informationen über die Schrittfolgen-Funktionen bei der Durchführung der Vorbereitungsverarbeitung oder der Nachanalyseverarbeitung sequentiell auszuführen,

dadurch gekennzeichnet, dass die Speichereinheit (25) ferner dazu ausgelegt ist, Informationen betreffend Wiederausführungs-Einstellungen zu speichern, um einen Wiederausführungs-Wartungsschritt vorzusehen, von dem aus die erneute Ausführung in Bezug auf den ausgesetzten Wartungsschritt gestartet wird, wenn die Schrittfolgen-Funktionen mit mehreren Wartungsschritten vor Beendigung unterbrochen werden, wobei die Informationen über die Wiederausführungs-Einstellungen über die Eingabeeinheit (12) eingegeben werden, wobei die Steuereinheit (3) dazu ausgelegt ist, die Wartung von dem Wiederausführungs-Wartungsschritt, der dem ausgesetzten Wartungsschritt zugeordnet ist, basierend auf dem ausgesetzten Wartungsschritt und der Information über die Wiederausführungs-Einstellung erneut auszuführen, wenn die Schrittfolgen-Funktionen der Vielzahl von Wartungsschritten unterbrochen werden.

2. Automatisches Analysegerät nach Anspruch 1, wobei die Steuereinheit dazu ausgelegt ist, den ausgesetzten Wartungsschritt und die Information über die Wiederausführungs-Einstellung auf der Anzeigeeinheit anzuzeigen, wenn die ausgesetzten Schrittfolgen-Funktionen erneut ausgeführt werden, und, basierend auf der Auswahlinformation, ob die erneute Ausführung von dem Wartungsschritt der erneuten Ausführung aus durchgeführt wird, das von der Eingabeeinheit eingegeben wird, oder die erneute Ausführung von einem beliebigen anderen Wartungsschritt aus durchgeführt wird, die erneute Ausführung von einem ausgewählten Wartungsschritt aus durchzuführen.
3. Automatisches Analysegerät nach Anspruch 1, wobei die Speichereinheit (25) dazu ausgelegt ist, Informationen über einen Wartungsschritt zu speichern, der als ein Unterbrechungsschritt eingestellt ist, der für jedes der Vielzahl von Wartungselementen vorgegeben ist, und die Steuereinheit (3) dazu ausgelegt ist, den Unterbrechungsschritt auszuführen, wenn die Information über den Unterbrechungsschritt für einem Wartungselement vorgegeben ist, bevor die angehaltenen Schrittfolgen-Funktionen wieder ausgeführt werden.

4. Automatisches Analysegerät nach Anspruch 3, wobei der Unterbrechungsschritt so eingestellt ist, dass er einer Vielzahl von Unterbrechungsursachen zugeordnet ist, für die die Schrittfolgen-Funktionen ausgesetzt werden, und
5
die Steuereinheit (3) den Unterbrechungsschritt auf der Grundlage der Unterbrechungsursache, für die die Unterbrechung aufgetreten ist, auswählt, wenn die unterbrochenen Schrittfolgen-Funktionen wieder ausgeführt werden.
10

Revendications

1. Analyseur automatique comprenant :
15
une unité d'analyse configurée pour analyser un échantillon liquide ;
une unité (12) d'entrée configurée pour entrer une condition d'analyse de l'échantillon liquide ;
20
une unité (18) d'affichage configurée pour afficher la condition d'analyse entrée ;
une unité (25) de stockage configurée pour stocker des données analysées dans l'unité d'analyse et la condition d'analyse ; et
25
une unité (3) de commande configurée pour commander l'unité d'analyse, l'unité (12) d'entrée, l'unité (18) d'affichage, et l'unité (25) de stockage,
30
dans lequel l'unité (25) de stockage est configurée pour stocker des informations sur des fonctions de canalisations, dans lequel les fonctions de canalisations sont une pluralité d'items de maintenance qui peuvent coopérer les uns avec les autres pour réaliser une fonction désirée, dans lequel les informations sur des fonctions de canalisations servent à exécuter séquentiellement une pluralité d'items de maintenance associés avec un processus de préparation mis en œuvre avant une analyse par l'unité d'analyse et un processus post-analyse mis en œuvre après une analyse par l'unité d'analyse, dans lequel les informations sur des fonctions de canalisations sont entrées depuis l'unité (12) d'entrée, et
35
dans lequel l'unité (3) de commande est configurée pour exécuter séquentiellement la pluralité d'items de maintenance sur la base des informations sur les fonctions de canalisations à la mise en œuvre dudit processus de préparation ou dudit processus post-analyse,
40
50

caractérisé en ce que

l'unité (25) de stockage est en outre configurée
55
pour stocker des informations sur un paramétrage de réexécution pour paramétrer un item de maintenance de réexécution à partir duquel

une réexécution est démarrée pour ce qui concerne l'item de maintenance interrompu si les fonctions de canalisations de la pluralité d'items de maintenance sont interrompues à mi-chemin,
dans lequel les informations sur un paramétrage de réexécution sont entrées depuis l'unité (12) d'entrée,
dans lequel l'unité (3) de commande est configurée pour réexécuter une maintenance à partir de l'item de maintenance de réexécution associé avec l'item de maintenance interrompu, sur la base de l'item de maintenance interrompu et des informations sur un paramétrage de réexécution, si les fonctions de canalisations de la pluralité d'items de maintenance sont interrompues.

2. Analyseur automatique selon la revendication 1, dans lequel l'unité de commande est configurée pour afficher l'item de maintenance interrompu et les informations sur un paramétrage de réexécution sur l'unité d'affichage lorsque les fonctions de canalisations interrompues sont réexécutées et est configurée pour mettre en œuvre une réexécution à partir d'un item de maintenance sélectionné, sur la base d'informations de sélection quant à savoir si une réexécution est mise en œuvre à partir de l'item de maintenance de réexécution entré depuis l'unité d'entrée, ou si une réexécution est mise en œuvre à partir d'un item de maintenance arbitraire différent.
3. Analyseur automatique selon la revendication 1, dans lequel l'unité (25) de stockage est configurée pour stocker des informations sur un item de maintenance paramétré comme un item d'interruption qui est paramétré pour chacun de la pluralité d'items de maintenance, et
l'unité (3) de commande est configurée pour exécuter l'item d'interruption, si les informations sur un item d'interruption sont paramétrées dans un item de maintenance, avant de réexécuter les fonctions de canalisations interrompues.
4. Analyseur automatique selon la revendication 3, dans lequel l'item d'interruption est paramétré de manière à être associé avec une pluralité de causes d'interruption pour lesquelles les fonctions de canalisations sont interrompues, et
l'unité (3) de commande est configurée pour sélectionner l'item d'interruption, sur la base de la cause d'interruption pour laquelle l'interruption est survenue, lorsque les fonctions de canalisations interrompues sont réexécutées.

FIG. 1

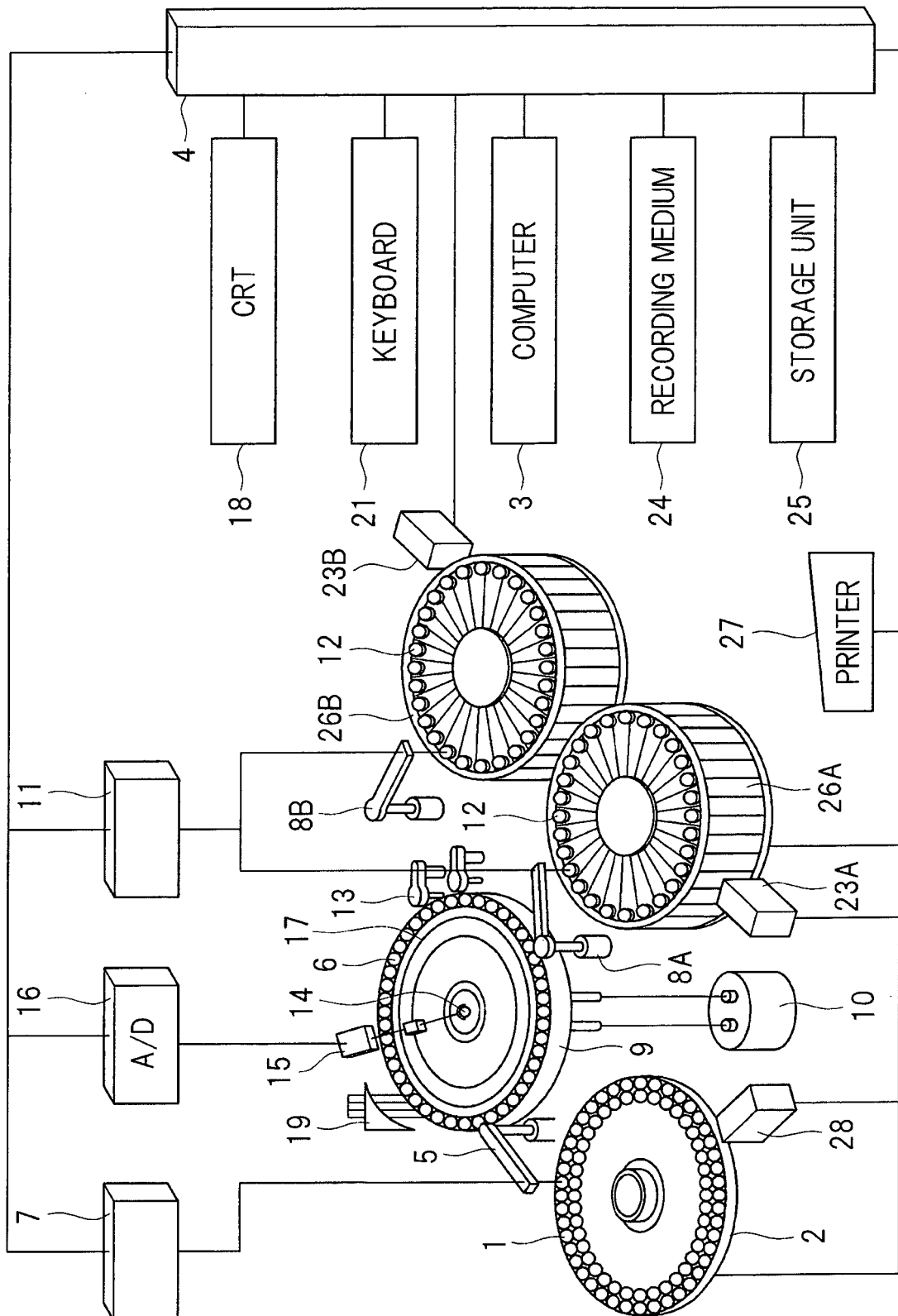


FIG. 2

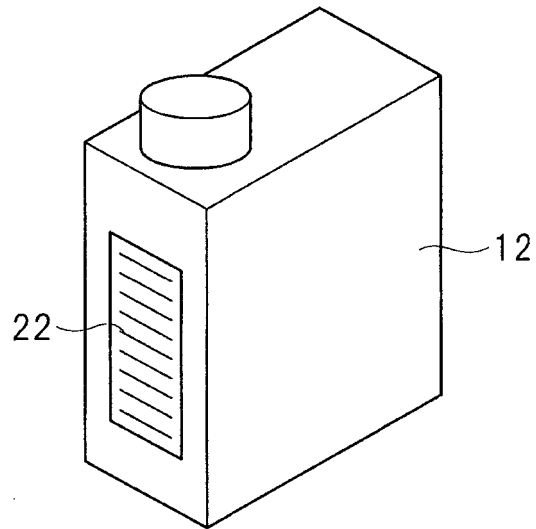


FIG. 3

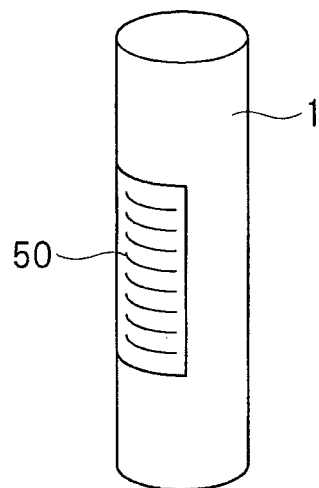


FIG. 4

PIPE FUNCTION SETTING

101

▲
MAINTENANCE ITEM
PHOTOMETER CHECK
CELL BLANK MEASUREMENT
INCUBATION WATER EXCHANGE
AIR PURGE
WASH REACTION PARTS
REAGENT PRIME
▼

102

No	PIPE FUNCTION ITEMS	RE-EXECUTION SETTING
1	AIR PURGE	1
2	REAGENT PRIME	1
3	INCUBATION WATER EXCHANGE	3
4	CELL BLANK MEASUREMENT	4
5	PHOTOMETER CHECK	4

103

ADD >

< CANCEL

DELETE

REGISTER

FIG. 5

PIPE FUNCTION SETTING

MAINTENANCE ITEM	▲
PHOTOMETER CHECK	
CELL BLANK MEASUREMENT	
INCUBATION WATER EXCHANGE	
AIR PURGE	
WASH REACTION PARTS	
REAGENT PRIME	
	▼

ADD >

< CANCEL

No	PIPE FUNCTION ITEMS	RE-EXECUTION SETTING
1	AIR PURGE	1 ▼
2	REAGENT PRIME	1 ▼
3	INCUBATION WATER EXCHANGE	3 ▼
4	CELL BLANK MEASUREMENT	4
5	PHOTOMETER CHECK	4

REGISTER

DELETE

103a

FIG. 6

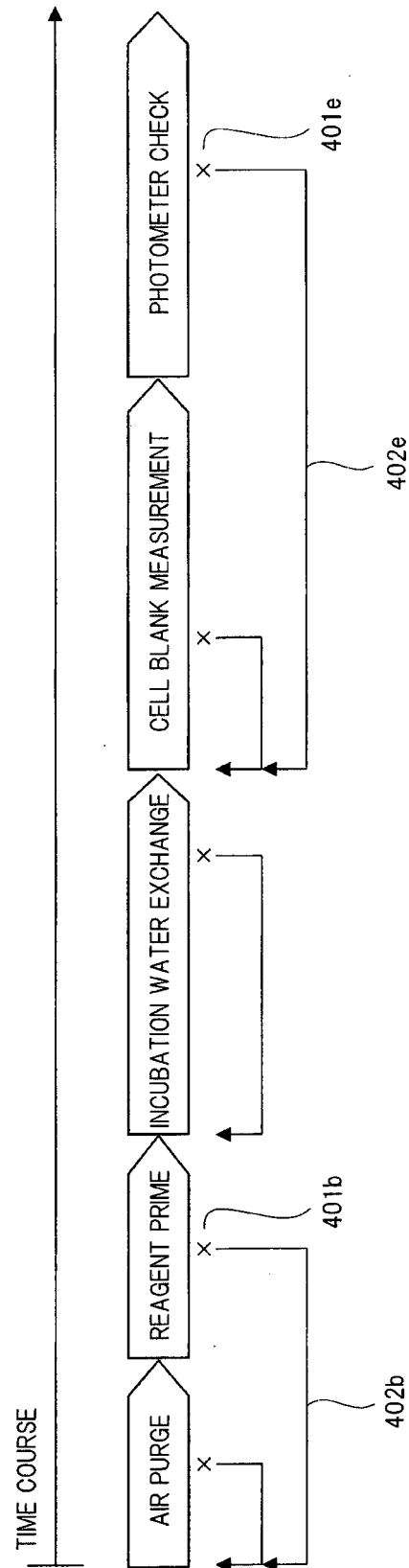


FIG. 7

MAINTENANCE		
INTENDED PURPOSE	MAINTENANCE ITEM	EXECUTION DATE AND TIME
MAINTENANCE	PHOTOMETER CHECK	2012/07/01 07:40:10
CHECK	CELL BLANK MEASUREMENT	2012/07/02 07:30:15
	INCUBATION WATER EXCHANGE	2012/07/02 07:15:35
	AIR PURGE	2012/07/02 07:00:10
	WASH REACTION PARTS	2012/07/01 18:59:00
	REAGENT PRIME	2012/07/02 07:02:05

RE-EXECUTION OF
PIPE FUNCTIONS

201

EXECUTE

FIG. 8

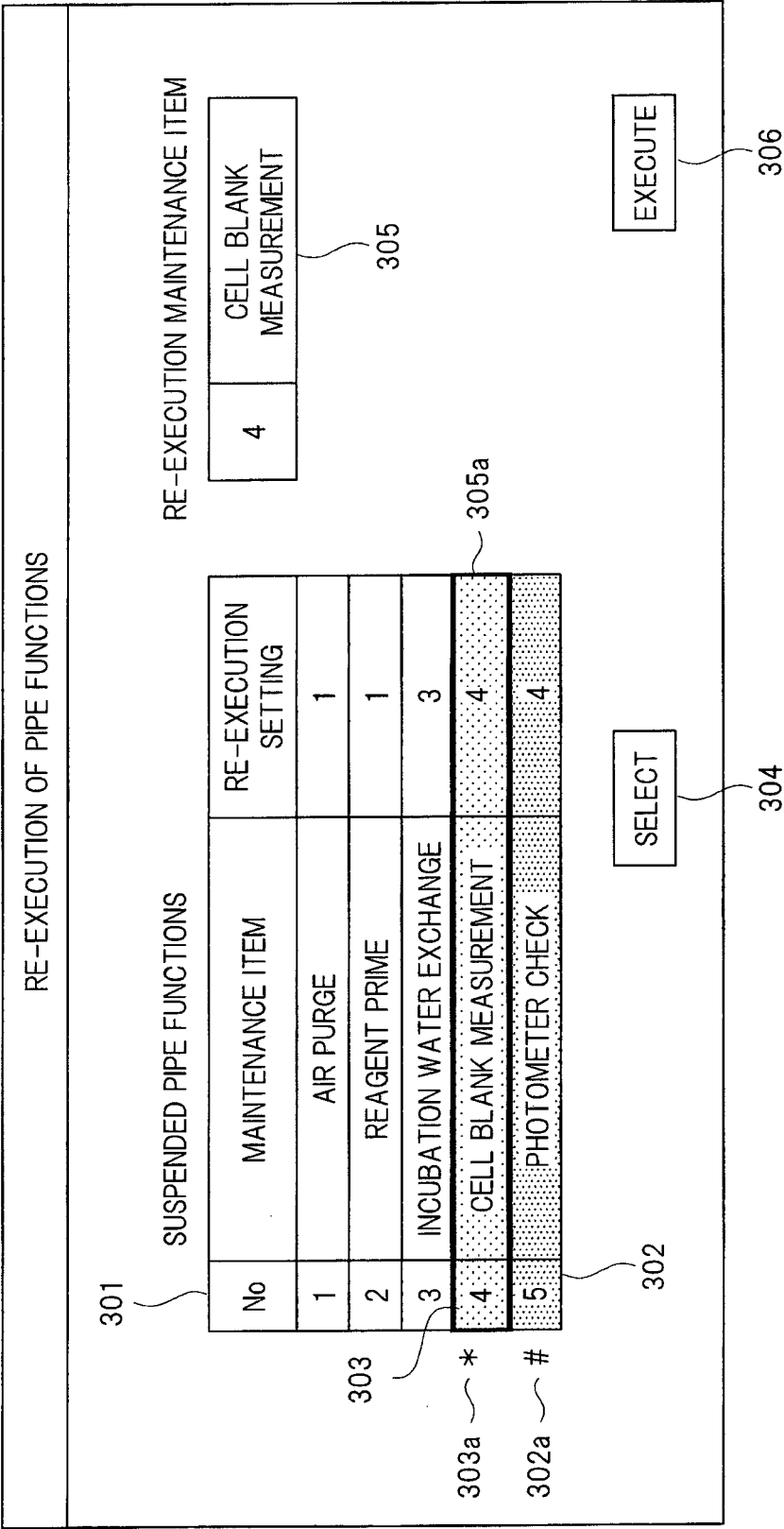


FIG. 9

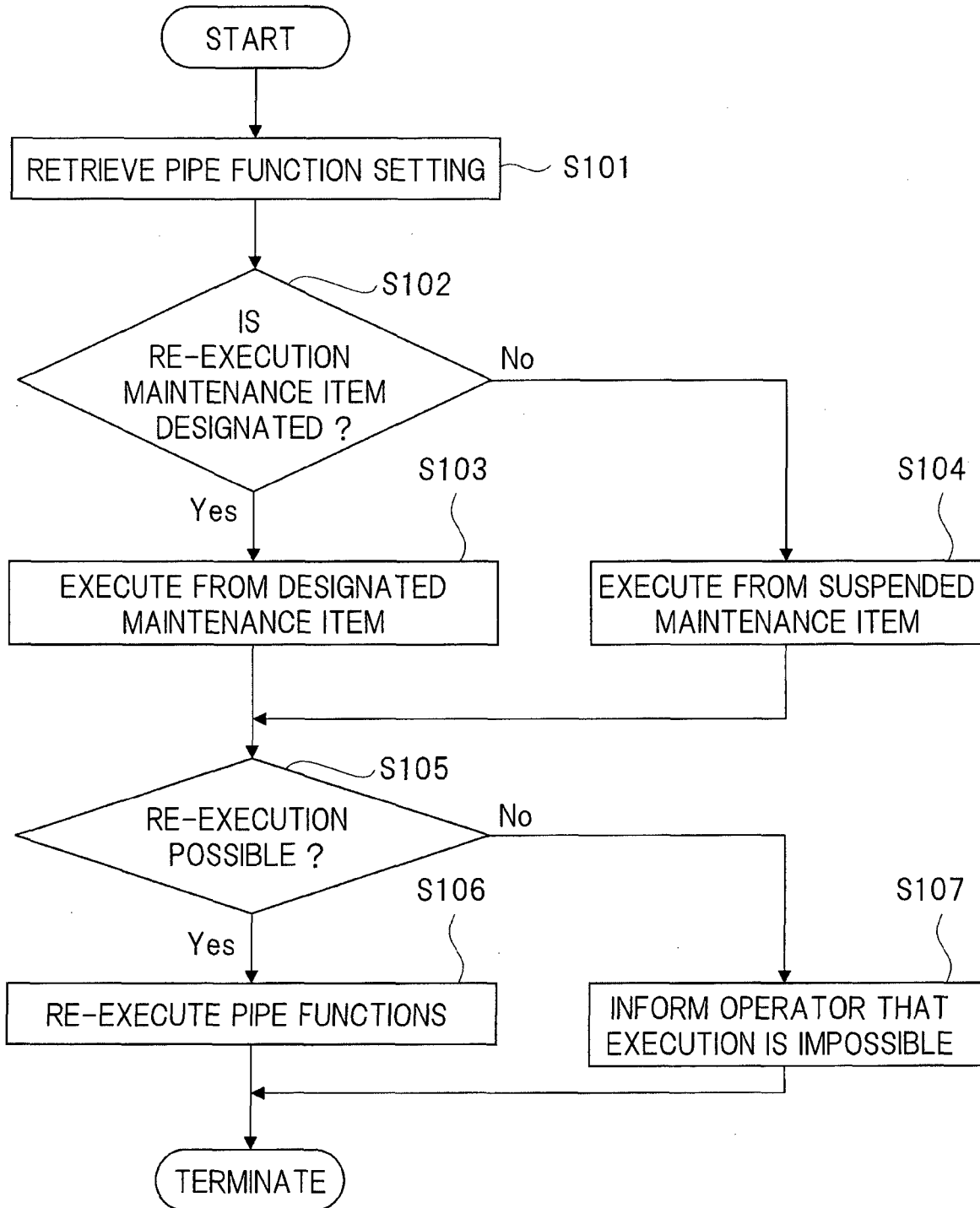


FIG. 10

PIPE FUNCTION SETTING

101

MAINTENANCE ITEM

PHOTOMETER CHECK

CELL BLANK MEASUREMENT

INCUBATION WATER EXCHANGE

AIR PURGE

WASH REACTION PARTS

REAGENT PRIME

▲

102

No

1

2

3

4

5

PIPE FUNCTION ITEMS

AIR PURGE

REAGENT PRIME

INCUBATION WATER EXCHANGE

CELL BLANK MEASUREMENT

PHOTOMETER CHECK

103

RE-EXECUTION SETTING

1

1

3

4

4

110

INTERRUPT ITEM

RESET

-

-

RESET

-

ADD >

< CANCEL

REGISTER

DELETE

FIG. 11

PIPE FUNCTION SETTING					
102		103	112		113
No	PIPE FUNCTION ITEMS	RE-EXECUTION SETTING	INTERRUPT ITEM DEPENDING ON CAUSE OF SUSPENSION		
			MECHANICAL SYSTEM FAILURE	CONSUMABLE SUPPLY SHORTAGE	
1	AIR PURGE	1	RESET	-	
2	REAGENT PRIME	1	-	REAGENT PRIME	
3	INCUBATION WATER EXCHANGE	3	-	-	
4	CELL BLANK MEASUREMENT	4	RESET	-	
5	PHOTOMETER CHECK	4	-	-	

図 11

一括準備動作設定						
102		103		112		113
一括準備項目		再実行設定	中断要因別割込み項目			
No			機構系異常	消耗品不足		
1	エアパージ	1	リセット	-		
2	試薬プライム	1	-	試薬プライム		
3	反応槽水交換	3	-	-		
4	セルブランク測定	4	リセット	-		
5	光度計チェック	4	-	-		

REFERENCES CITED IN THE DESCRIPTION

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